819 LIGHTING AND ELECTRICAL MATERIALS

819.01 GENERAL

Fluorescent luminaires, sign lighting luminaires, street lighting luminaires and standards, underpass luminaires, conduit, boxes, service control equipment cabinets, switches, circuit breakers, contractors, time switches, distribution panels, wire and cable, transformers, lamps, plugs, receptacles, and the like shall meet the requirements herein and as shown on the plans.

819.02 LIGHTING STANDARDS

Lighting standards including arms shall meet the requirements of AASHTO Specifications for the Design and Construction of Structural Supports for Highway Luminaires, shall conform to the District of Columbia Commissioners' Order 60-1090 and be fluted standard steel or aluminum as specified and shown on Traffic and Electrical Services Division, Department of Public Works Drawing No. 2 or 2-AA, and installed at locations and in accordance with details shown on the plans and connected in accordance with the wiring diagrams. The wiring, depending on locations, may be either series or multiple.

A strain-relief cable grip shall be provided inside the pole to support the pole cable.

819.03 LUMINAIRES

Luminaires shall be suitable for use in a multiple circuit and shall provide for use of high pressure sodium vapor lamps, metal halide lamps or mercury vapor lamps as provided in the plans. The luminaires shall consist of housing, reflectors, refractor- holders, slip-fitters, and pole side mounted mogul lamp sockets, photocell receptacles, and integral, regulator time ballasts. The complete unit shall have uniform lines throughout, and thus aesthetically combine all components.

819.04 HOUSING ASSEMBLIES

The housing assemblies shall consist of durable lightweight aluminum alloy. The housings shall be die cast. The die cast aluminum slip fitter for 1-1/2 or 2 inch pipe bracket shall be integral parts of the castings and shall have not more than an 8 inch long nor less than a 5 inch horizontal insertion length on the 2 inch bracket arms and shall be adequately equipped with clamping and leveling devices or a similar mechanism to allow proper clamping and positioning of the luminaires on the bracket arms.

The optical system shall be filtered against entry of insects, rain, dust, and other offending foreign matter.

The lowest part of the luminaires shall be bottom castings of the same material as the housings, hinged and latched to the upper castings. In the closed position, the refractor supported by the casting shall be held against the gasketed reflector so as to form dustproof and weatherproof assemblies. In the open position, the units shall provide for access to the lamps, reflectors, and sockets and for easy adjustments of the mounting cradles and the lamps.

The housing assemblies shall be provided with separate detachable doors to which the ballasts (and starting aids if required) are mounted.

819.05 BALLASTS

Luminaires shall be provided with integral ballasts of regulator type, high power factor, operating from multiple circuits, and pre-wired to the luminaire assemblies.

819.06 SOCKETS

Mogul multiple sockets shall be of the standard low voltage design, except the terminals shall be of nickel-plated bronze construction with screw clamp type terminal with friction grips and provide for mounting on the pole side of the luminaries. The sockets shall be adjustable to produce IES specified time distribution with specified lamps and prismatic refractors.

819.07 REFLECTORS

Internal reflectors shall be precisely contoured and the inner surfaces shall be highly specular to give, with the refractor, optimum light output and control. Reflectors shall be self-aligning, held in position with snap-in fasteners, and shall require no tools for removal or replacement. The silicon rubber formed gaskets shall be so arranged as to insure proper setting of the refractors against the reflectors.

819.08 REFRACTORS

Refractors shall be pressed clean crystal glass of the borosilicate type to resist breakage due to heat and mechanical stresses, well annealed, and free from imperfection. The sides or beam sections of the refractors shall contain panels of prisms to accept light from the reflector and refract it to the desired beam direction.

The house side of the refractors shall have smooth inside surfaces and shall contain double duty prisms on the outside, consisting of small refracting prisms, superimposed on larger horizontal prisms to refract light back into the street area.

The street end of the refractors shall contain radial prisms on the inside to spread light along the street area, and outside prisms that lie approximately in a plane slanting down between the luminaire and opposite curb line to refract light downward into the street area for improved illumination uniformity and street side shielding.

The bottom sections of the refractors shall contain outside prisms on the back portion to refract downward light in a forward direction under the luminaire into the street area. The forward position of the bottom shall contain "exploding" prisms on the inside that are contoured in segments of circles to refract light out in all directions that would normally go directly beneath the luminaire, in order to reduce excess light under the luminaire.

Refractors shall be clearly embossed with the designation "street side." They shall be so contoured and of sufficient thickness to resist malicious breakage. Refractors shall have a minimum volume of 520 cubic inches.

819.09 JUNCTION BOXES AND COVERS

Junction boxes and covers shall be hot-dipped galvanized in accordance with AASHTO M 111. Junction boxes shall be NEMA Type 4 of the size specified, shall be UL approved, and shall be watertight.

Conduit entrances shall be provided with threaded bosses. A neoprene gasket shall be cemented to the cover. Boxes shall be cast iron unless otherwise specified on the contract plans.

819.10 GROUND RODS

Ground rods shall be of copper encased steel, 15 feet long, and unless otherwise noted on the plans, 3/4 inch in diameter. Extensions shall be 10 feet in length.

819.11 WIRES

All wires used shall bear the UL label. All single conductor cable shall be provided with permanent identification on the outer protective covering, showing size, type, style, and voltage. Unless specified otherwise in the contract documents, wires shall conform to the following:

(A) Wires for street lighting system and general wiring shall be minimum size No. 10 AWG, 600 volts, copper conductor, Class B Standard, Type THWN, meeting the requirements of latest publications of IPCEA Standard S-61-402.

(B) Wire used for service and feeder shall be Type XHHW, copper, Class B stranded.

(C) Wires used for vehicle detector loops shall be Type XHHN, copper, Class B Stranded.

(D) Wire used for grounding shall be bare or insulated, copper, soft drawn, stranded, sized as noted on the plans, and shall conform to ASTM B 33 or ASTM B 189. Stranded wire shall conform to ASTM B 8.

(E) Wire Color Code

120/208 Volt	**Color**	**277/480 Volt**	**Color**
Phase A	Black	Phase A	Yellow
Phase B	Red	Phase B	Brown
Phase C	Blue	Phase C	Orange
Neutral	White	Neutral	White
Ground	Green		
Switch Leg	Purple		

819.12 ELECTRICAL CONDUIT

Conduit and fittings specified in the Special Provisions and where shown on the plans shall conform to the following:

(A) METALLIC CONDUIT.

(1) Hot-dip galvanized steel conduit shall conform to the requirements of ASTM A 53, UL 6 and FS WW-C-581E, be rigid, and bear the UL label.

(2) Zinc-coated steel conduit shall conform to the requirements of UL 6 and FS WW-C-581E and bear the UL label, and shall be rigid.

(3) Plastic coated galvanized steel conduit shall conform to the requirements of UL 6 or ASTM A 53, be rigid and hot-dip galvanized, including threads and have a PVC plastic coating of at least 40 mils in thickness, intimately bonded to the outer galvanized surface. The threads and the interior surface shall be bonded with urethane coating.

(4) Corrosion resistant steel conduit shall conform to ASTM A 333, Grade 9, except that the chemical requirements are amended to read phosphorous, maximum .095 percent.

(5) Aluminum conduit shall conform to the requirements of UL 6 and bear the UL label.

(B) NON-METALLIC CONDUIT.

(1) Heavy wall PVC conduit, Type II or Schedule 40, shall conform to Federal Specification 1094A and UL 651, and bear UL label.

(2) High density polyethylene conduit, Type III, shall conform to UL 651 and bear the UL label.

(C) BITUMINOUS-FIBER CONDUIT. Bituminous fiber conduit, Type II, shall conform to FS W-C-581 or W-C 575.

(D) FIBERGLASS REINFORCED EPOXY CONDUIT. FRE conduit shall be heavy wall type and conform to NEMA TC-14 and bear the UL label.

819.13 CONDUIT EXPANSION AND DEFLECTION FITTINGS

The conduit expansion and deflection fitting shall be designed to compensate for 3/4 inch movement in any direction between two steel conduits and an angular movement of thirty degrees. The end coupling shall be bronze, and the sleeve shall be neoprene with internal copper bonding jumper.

Conduit expansion fittings shall be provided with a 4 inch minimum free length expansion chamber. This metal fitting shall be provided with an internal bonding assembly and external bonding jumper assembly approved by Underwriter's Laboratories, Inc. The body shall be malleable iron, hot dip galvanized, and the expansion head shall be bronze.

819.14 CIRCUIT IDENTIFICATION MATERIALS

Tags to be used as specified shall be circular in shape, 1-5/8 inch minimum diameter, 0.031 inch minimum thickness, copper, plastic, brass, or fiber tags except that tags within switch and device cabinets shall be of nonmetallic material. Identifying bands shall be approximately 1/32 inch thick, 3/16 inch wide, and 4 inch minimum length nylon, self- clinching type with adequate sized tab for labeling. Tags shall be permanently fastened to cables by means of tying straps of the same material and dimensions as identifying bands without tabs. Each tag or band tab shall be marked using 1/4 inch minimum lettering dies, engraving device or other equivalent permanent marking process. Markings shall indicate "GRD" for all ground and grounded neutral conductors. Companion circuit conductors shall be marked "CKT" followed by the designated letter, numeral, or symbol as may be shown on the plans.